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LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE

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16. Abstract Changes in land use in the Phoenix (1:250,000-scale) Quadrangle in Arizona have been mapped using only the images from ERTS-1, tending to verify the utility of a land use classification system proposed for use with ERTS images. The period of change investigated was from November 1970 to late Spring 1973. Seasonal changes were studied on successive ERTS images, particularly large scale color composite transparencies for August, October, February, and May, and this seasonal variation aided delineation of land use boundaries. Types of equipment used to aid interpretation included color additive viewer, a twenty-power magnifier, a density slicer, and a diazo copy machine. A Zoom Transfer Scope was used for scale and photogrammetric adjustments. Types of changes detected have been (a) cropland or rangeland developed as new residential areas, (b) rangeland converted to new cropland or to new reservoirs and (c) possibly new activity by the mining industries. A map of land use previously compiled from air photos was updated in this manner. ERTS images complemented air photos: the photos gave detail on a one-shot basis; the ERTS images provided currency and revealed seasonal variation in vegetation which aided interpretation of land use.			
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Figure 2A. Technical Report Standard Title Page. This page provides the data elements required by DoD Form DD-1473, HEW Form OE-6000 (ERIC), and similar forms.

Type II Progress Report.

ERTS-1

1 July 1973 - 31 December 1973

- a. Land Use Mapping and Modelling for the Phoenix Quadrangle.
(ERTS-A Proposal SR-186)

- b. IN-057

- c. Statement and explanation of any impedance:

Nearly all impedances have been eliminated. Lack of recent aerial photography over the southern 10% of the Phoenix Quadrangle limits accuracy checks of ERTS interpretations.

- d. Accomplishments during the reporting period and those planned for the next period:

The MSS 9 x 9 image of the Phoenix metropolitan area taken on June 25, 1973 has been compared with the first MSS 9 x 9 of that area taken on August 23, 1972. Natural vegetation appears to be more lush in the June image. This could be attributed to the abnormally large amount of precipitation received so far this year and also because the image shows conditions two months earlier in the summer season. Reservoir levels are also higher in the 1973 image. The most noticeable land use changes have been the filling of Painted Rock Reservoir, which has resulted in the change of agricultural and rangeland to water in the southern portion of the test site and a major addition to the Sun City development, which has been expanding northward resulting in the change from agricultural land to urban land use.

A Level II land use overlay has been made that covers much of the eastern third of the test site. The overlay has been compiled on a 1:100,000 scale print base made from a portion of an ERTS color composite image. Land use in the area around metropolitan Phoenix has been mapped with as much detail, i.e., second level, as possible, although all Level II categories were not interpretable.

In connection with the review of ERTS-1 Investigations Status by the Land Use Panel at Goddard Space Flight Center on October 25, 1973, two overlays have been prepared for the 1:250,000 scale land use map of the Phoenix Quadrangle. These overlays cover the eastern half of the test site, including the metropolitan Phoenix area within the quadrangle. Level I land use changes have been mapped. The first overlay shows land use changes detected from high altitude aerial photography for the period November 1970 to

November 1972. The second overlay shows land use changes detected from ERTS imagery for the period November 1970 to May 1973.

A presentation of accomplishments and current status of ERTS work in the Phoenix Quadrangle was given at the NASA/ERTS-1 Third ERTS Symposium at Washington, D.C., on December 11, 1973. In connection with the preparation of the report, twenty-five graphics were prepared which should be of continuing value to the research effort.

During the next reporting period, more experimentation will be done with anniversary images in an effort to improve change detection accuracy and efficiency. The existing computer data base for the Phoenix Quadrangle will be updated to reflect these changes and a new map will be plotted and statistical analyses run.

e. Scientific results and practical applications:

In comparing the land use changes from the overlay as detected from ERTS and the high altitude change overlay compiled from the November 1972 aerial photography, total areas of change were of the same magnitude. The clusterings or distributions of changes on both of the overlays were quite similar. The greatest variations were a result of differences in dates and areas of coverage between ERTS images and aerial photographs. The greatest accuracy was obtained in the water classification, where interpretations were virtually identical. Land use changes from rangeland to agricultural land were normally detectable, although ERTS images did not always show new agricultural land which was not in crops. Land changing from agricultural to urban use presented more problems. Individual land units changing were usually smaller than the types previously mentioned. Lack of landscaping vegetation in newly developed residential areas often caused them to be overlooked during interpretation of ERTS images. In the larger parcels and in those with landscaping vegetation present, the results were more than 90% accurate. ERTS is a useful tool in monitoring urban advance on the western Phoenix fringe.

Attempts to arrive at a precise accuracy statement were handicapped by the fact that most of the ERTS imagery which has been used was taken after the high altitude aerial photography was taken and also by the lack of photography over the southern edge of the test site.

Residential land use can usually be delineated provided that landscaping vegetation is present. Extractive industries can be delineated where open pit or strip mining is practiced and where tailings, dumps, or ponds are visible on the imagery. In the transportation, communications, and utilities category, larger airports and railroad yards are usually the only mappable features.

Highways, although often visible, are rarely delineated as land use categories because the corridor they occupy is below minimum mapping size.

Separation of citrus from other agricultural land has been moderately successful in the ERTS 1:100,000 scale Level II land use mapping around Phoenix. No feeding operations have been detected from ERTS so far. Preliminary indications are that commercial and services, industrial, and institutional land are not reliably separable from each other using present image interpretation techniques. Urban open areas such as parks and golf courses are readily detectable, particularly when local maps are consulted even though out-of-date. Strip and clustered settlements may be detected depending upon their size and contrast with the surrounding area on the ERTS image.

f. Published reports and talks:

"Change in Land Use in the Phoenix (1:250,000) Quadrangle, Arizona Between 1970 and 1973: ERTS as an Aid in a Nationwide Program for Mapping General Land Use," by John L. Place, U.S. Geological Survey, Geographic Applications Program, was presented at the NASA/ERTS-1 Symposium, Washington, D.C., December 10-13, 1973.

g. Recommendations for improvements:

The generally consistent framing of land areas by ERTS has been very helpful when comparing data for specific locations over time. However, the June 25 ERTS images over Phoenix bisected the metropolitan area along an east-west axis. This was inconsistent with previous Phoenix images. Consistent framing of MSS images along the orbital track would be of substantial benefit.

Supplying investigators with selected color composite imagery definitely increases their ability to extract photo interpretable data. However, lack of careful registration of the band images used to create the composite seriously limits the effectiveness of the product. Better quality control in the production of retro-spectively-ordered color composite images would allow investigators to glean the maximum amount of data from the imagery.

h. Changes in Standing Order Forms:

None.

i. ERTS Image Descriptor Forms:

No new descriptors have been detected.

j. Changed Data Request Forms submitted to Goddard Space Flight Center/NDPF:

None.